ISEBE LEMFUNDO LEMPUMA KOLONI
EASTERN CAPE EDUCATION DEPARTMENT
OOS-KAAP ONDERWYSDEPARTEMENT

NATIONAL SENIOR CERTIFICATE

GRADE 12

ENGINEERING GRAPHICS AND DESIGN P2

SEPTEMBER 2021

PREPARATORY EXAMINATION

MARKS: 200

TIME: 3 hours

This question paper consists of 6 pages.

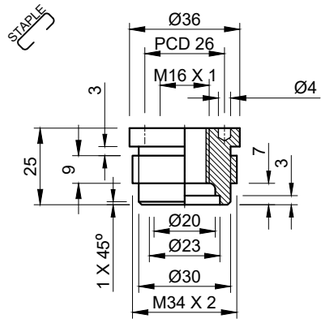
INSTRUCTIONS AND INFORMATION

1. The question paper consists of FOUR questions.
2. Answer ALL the questions.
3. ALL drawings must be drawn to scale 1 : 1, unless otherwise stated.
4. ALL questions must be answered on the answer sheets provided.
5. ALL the answer sheets must be re-stapled in numerical sequence and handed in irrespective of whether the question was attempted or not.
6. Careful time management is essential in order to complete all the questions.
7. Print your name in the block provided on every ANSWER SHEET.
8. ALL answers must be drawn accurately and neatly.
9. Any details or dimensions not given must be estimated in good proportion.
10. ALL drawings are in third angle orthographic projection, unless otherwise stated.

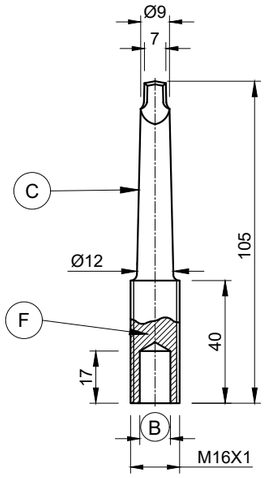
FOR OFFICIAL USE ONLY								
					MODERATED MARK			
1								
2								
3								
4								
TOTAL								
	2	0	0		2	0	0	

FINAL CONVERTED MARK	CHECKED BY
100	

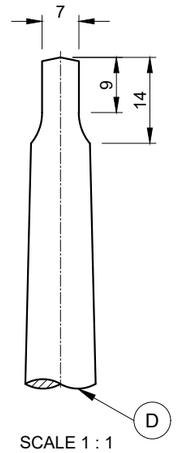
COMPLETE THE FOLLOWING:
NAME
NAME
EXAMINATION CENTRE
SCHOOL



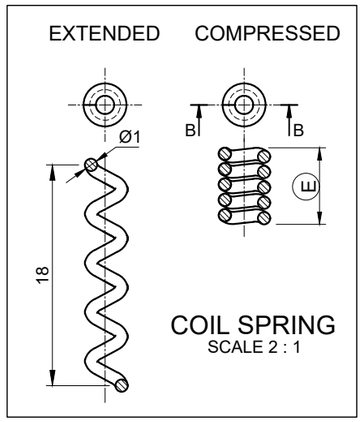
COLLAR



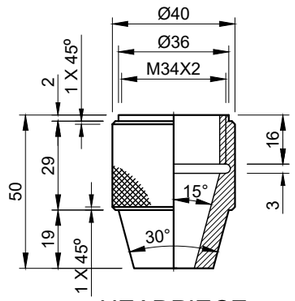
SHAFT



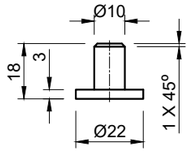
SCALE 1 : 1



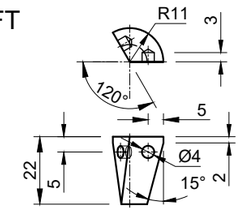
COIL SPRING
SCALE 2 : 1



HEADPIECE

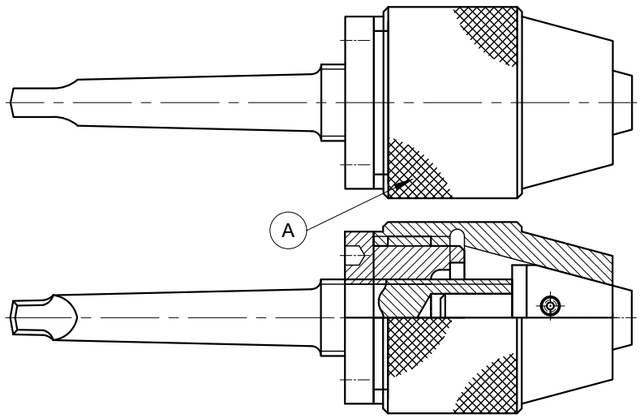


JAW GUIDE

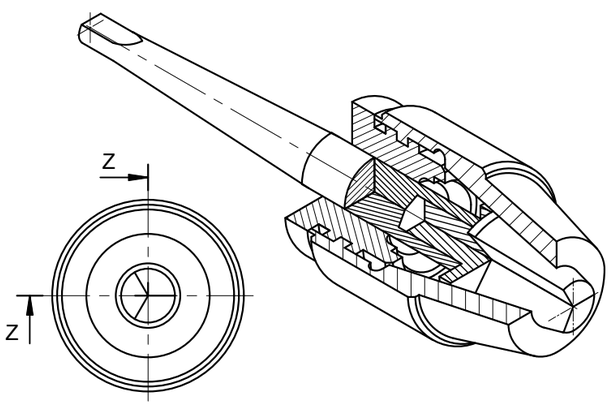


JAW

COMPRESSED COIL SPRING



VIEW 2



ASSEMBLY

OREGON MECHANICAL MANUFACTURES	5 LEOPOLD STREET QONCE 5600 ☏ 043 604 8300
TITLE: **KEYLESS CHUCK**	
ALL UNDIMENSIONED RADII ARE R2.	
ALL DIMENSIONS ARE MILLIMETRES.	SCALE: NTS
PROGRAMME: AUTOCAD 2020	
FILE NAME: EX127.dwg	
PATENTED: 2015	
QUANTITY: 300	

PARTS LIST

PART	MATERIAL	QUANTITY
1. COLLAR	STEEL	1
2. HEADPIECE	STEEL	1
3. SHAFT	STEEL	1
4. JAW	STEEL	3
5. JAW GUIDE	MCS	1
6. COIL SPRING	COPPER	3

REVISIONS	DATE
3.	
2. INSERT COIL SPRINGS AND HOLES ON THE ISOMETRIC VIEW.	2021/04/15
1. THREAD NEEDS TO BE HATCHED AT SHAFT.	2021/04/15

APPROVED:	DHLABA	2021/05/15
CHECKED:	BOOYSEN	2021/04/15
DRAWN:	VELLUM	2020/12/15

NAME

NAME 2

QUESTION 1: ANALYTICAL (MECHANICAL)

Given:
A detailed drawing of a keyless chuck, a title block, assembled views and a table of questions. The drawings have not been prepared to the indicated scale.

Instructions:
Complete the table below by neatly answering the questions, which all refer to the accompanying drawings and the title block. **[27]**

	QUESTIONS	ANSWERS		
1	What is the name of the company?		1	
2	In which street is the company based?		1	
3	Who approved the drawing?		1	
4	What is the feature at D called?		1	
5	How many parts are used to manufacture the chuck?		1	
6	How many jaws, in total, must be manufactured?		2	
7	What is the feature at A?		1	
8	What type of section resulted from cutting plane Z-Z?		1	
9	Name the type of section at F.		1	
10	What does PCD mean?		1	
11	Determine the measurement at E.		1	
12	Determine the measurement at B if it needs to be 0,1 mm bigger than the shaft that penetrates it.		1	
13	What was the second correction of the drawing and was it corrected?		2	
14	What is the feature at C?		1	
15	What does the two, in M34 x 2, mean?		1	
16	How many turns does the coil spring have?		1	
17	When was the keyless chuck patented and what does that mean?		2	
18	In the space below (ANSWER 18), draw, in neat freehand, the SANS symbol for a coil spring.		3	
19	In the space below (ANSWER 19), draw, in neat freehand, the SANS symbol for the projection system used.		4	
		TOTAL	**27**	

ANSWER 18

ANSWER 19

STAPLE

0°

A

QUESTION 2.1: LOCI (CAM)

Given:
- The bottom left 0° starting position of the displacement graph on the answer sheet for a cam.
- The specifications of the motion of the cam.

Specifications:
The cam imparts the following motion to the follower:
- The cam dwells for a period of 30°.
- It rises 60 mm with simple harmonic motion over the next 180°.
- The cam dwells for 60°.
- It returns to the original position with uniform acceleration and retardation over the rest of the rotation.

Instructions:
- Draw, to a displacement scale of 1 : 1 and horizontal scale of 360° = 120 mm, the complete displacement graph for the required motion.
- Label the graph and indicate the scale.
- Show ALL necessary construction. **[17]**

ASSESSMENT CRITERIA			
1	CONSTRUCTION	2	
2	1ST DWELL + SIMPLE HARMONIC	7	
3	2ND DWELL	$\frac{1}{2}$	
4	ACCELERATION AND RETARDATION	$6\frac{1}{2}$	
5	LABEL + SCALE	1	
	SUB-TOTAL 2.1	**17**	

QUESTION 2.2: LOCI (MECHANISM)

Given:
- Figure 1 shows the detail of a camshaft follower AB at its lowest point, connecting rod BE that is connected onto the camshaft follower AB as well as rotating crank CD.
- Figure 2 shows the schematic diagram of the drawing.
- Starting point A of the follower.

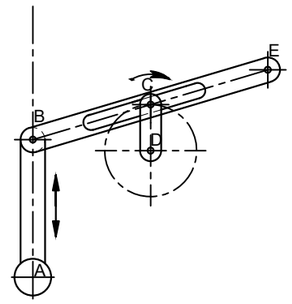


FIGURE 1:

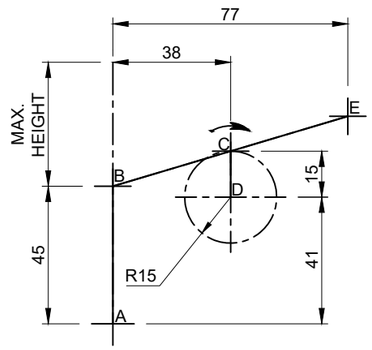


FIGURE 2:

Motion:
- The follower reciprocates (up and down) on the vertical centre line.
- The maximum height the follower moves from point B is 40 mm.
- Follower AB moves upwards for the first 6 segments of the cam until it reaches the maximum height of 40 mm from point B.
- The follower then moves down to the original position for the last 6 segments of the cam.
- Rod BE moves as crank CD rotates clockwise around fixed point D.

Instructions:
- Draw the given schematic diagram (FIGURE 2).
- Project and draw the loci of point E to the given motion.
- Show ALL necessary construction. **[19]**

ASSESSMENT CRITERIA			
1	CONSTRUCTION OF DIAGRAM	$4\frac{1}{2}$	
2	CONSTRUCTION OF 6 EQUAL PARTS	2	
3	CONSTRUCTION OF LOCI	$5\frac{1}{2}$	
4	LOCI OF POINT E	7	
	SUB-TOTAL 2.2	19	
	SUB-TOTAL 2.1	17	
	TOTAL	**36**	

NAME	
NAME	3

STAPLE

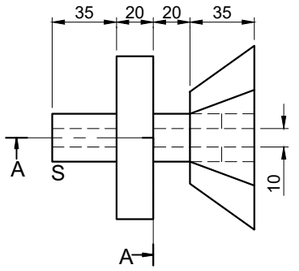
QUESTION 3: ISOMETRIC

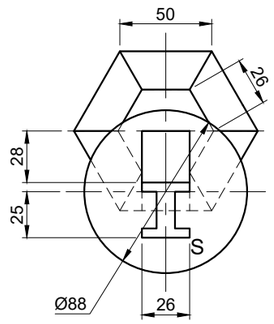
Given:

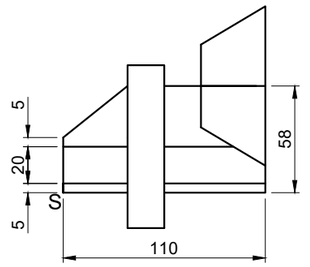
- Three views of a FIGURE in third angle orthographic projection.
- Cutting plane A-A as seen in the top view.
- Starting point S.

Instructions:

- Draw, to scale 1 : 1, a sectional isometric view of the FIGURE.
- Make point S the lowest point of the drawing.
- Show ALL necessary construction.
- NO hidden detail is required. **[37]**





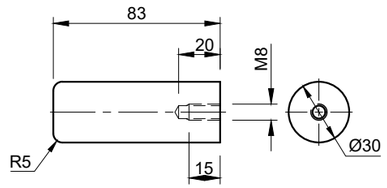


S

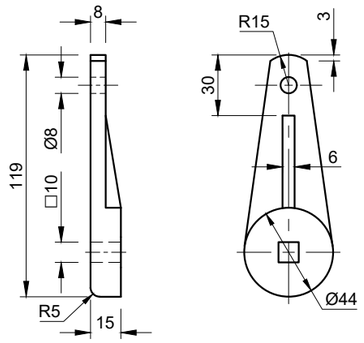
ASSESSMENT CRITERIA			
1	CONSTR' + PLACEMENT	3	
2	ISOMETRIC LINES	10	
3	RIB	5	
4	HEXAGON	7	
5	HALF CIRCLE	$3\frac{1}{2}$	
6	SECTION + HATCHING	$8\frac{1}{2}$	
	TOTAL	**37**	

NAME	
NAME	4

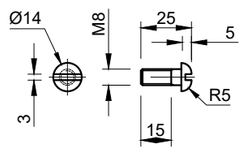
STAPLE



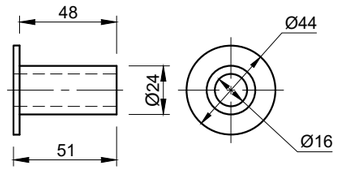
HANDLE (1)



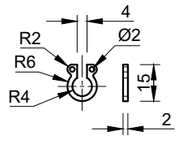
CRANK (2)



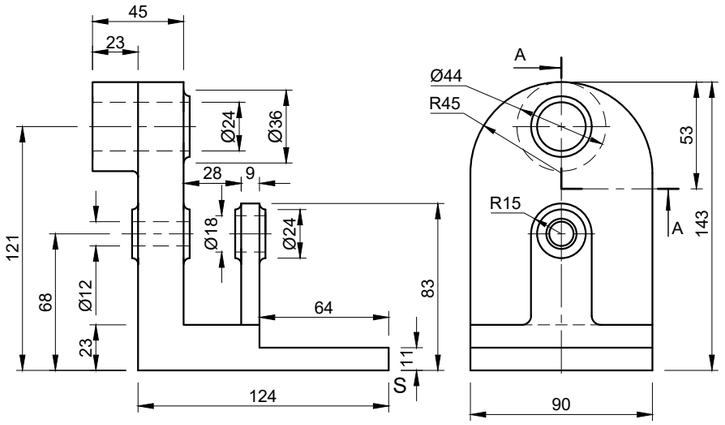
SCREW (3)



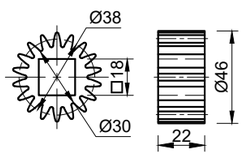
BUSH (4)



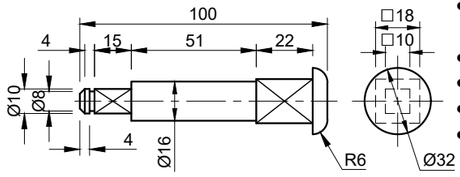
CIRCLIP (5)



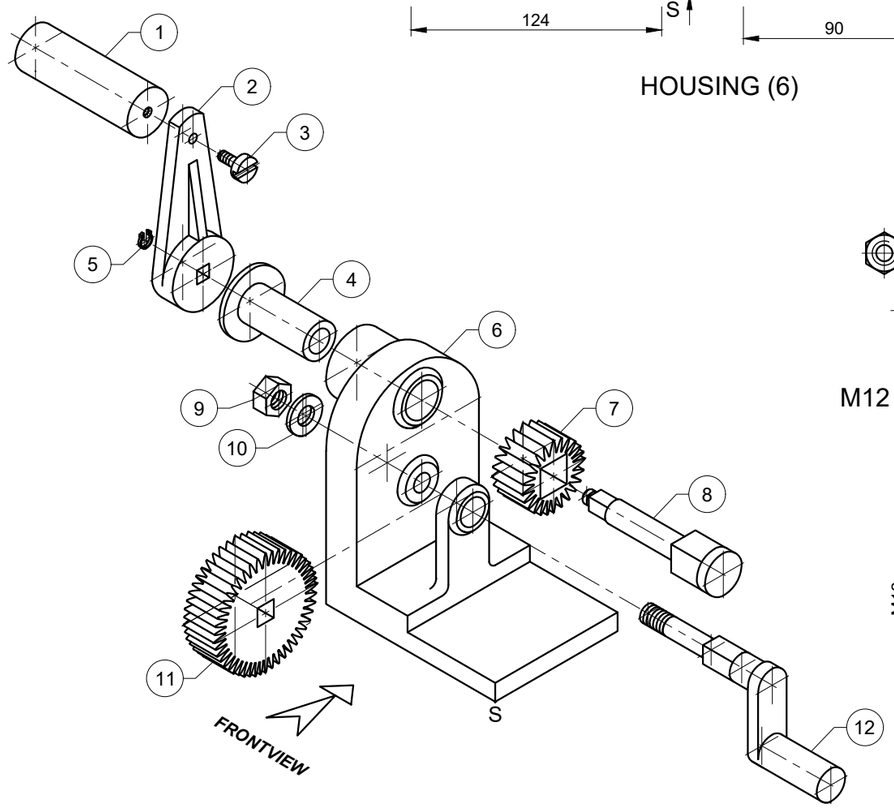
HOUSING (6)

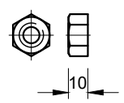


INPUT GEAR (7)

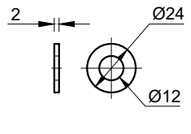


SHAFT (8)

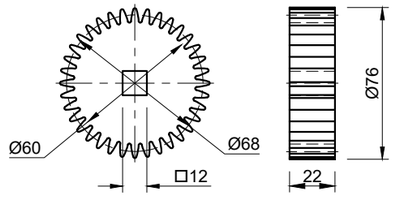




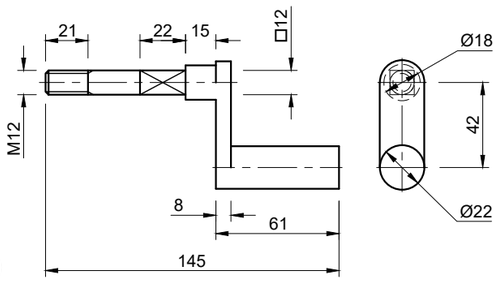
M12 NUT (9)



WASHER (10)

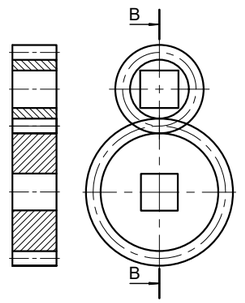


OUTPUT GEAR (11)



CRANKSHAFT(12)

CONVENTIONAL METHOD:



QUESTION 4: MECHANICAL ASSEMBLY

Given:

- The exploded isometric drawing of the parts of a gear drive assembly, showing the position of each part relative to the others.
- Orthographic views of each of the parts of the gear drive.
- Starting point S indicated on the front view of the housing and also on the answer sheet, page 6.

Instructions:

- Answer this question on page 6.
- Draw, to scale 1 : 1 and in third angle orthographic projection, the following view of the assembled parts of the gear drive.
- **The half sectional front view** of the gear drive assembly, on cutting plane A-A, as seen from the direction of the arrow shown on the exploded isometric drawing. The cutting plane is shown on the right view of the housing (part 6).

NOTE:

- The crank (part 2) and the crankshaft (part 12) must be drawn in their vertical position as seen in the exploded isometric view.
- Show**,** in the sectional front view, THREE faces of the M12 nut.
- Show ALL nut construction.
- NO hidden detail is required.
- All drawings must comply with the guidelines contained in *SANS 10111*.

Add the following features on the drawing:

- Label the view: **HALF SECTIONAL FRONT VIEW**
- Indicate the scale **[100]**

TITLE:

GEAR DRIVE

OREGON
MECHANICAL MANUFACTURES

5 LEOPOLD STREET
QONCE
5600
☎ 043 604 8300

ALL DIMENSIONS ARE MILLIMETRES.

ALL UNSPECIFIED RADII ARE R3.

PARTS LIST

PART	MATERIAL	QUANTITY
1. HANDLE	PVC	1
2. CRANK	CAST IRON	1
3. SCREW	STD	1
4. BUSH	COPPER	1
5. CIRCLIP	STD	1
6. HOUSING	CAST IRON	1
7. INPUT GEAR	ALUMINIUM	1
8. SHAFT	STEEL	1
9. M12 NUT	STD	1
10. WASHER	CAST IRON	1
11. OUTPUT GEAR	ALUMINIUM	1
12. CRANKSHAFT	STEEL	1

Please turn over

STAPLE

PENALTIES		
1	WRONG SCALE -2	
2	WRONG PLACING OF VIEWS -2	
3	PARTS NOT ASSEMBLED -2	
4	WRONG HATCHING -2	
	TOTAL PENALTIES (-)	

ASSESSMENT CRITERIA			
HALF SECTIONAL FRONT VIEW			
1	HANDLE	9	
2	SCREW	$9\frac{1}{2}$	
3	CRANK	$8\frac{1}{2}$	
4	BUSH	$5\frac{1}{2}$	
5	SHAFT	12	
6	CIRCLIP	$2\frac{1}{2}$	
7	INTPUT GEAR	5	
8	HOUSING	$16\frac{1}{2}$	
9	OUTPUT GEAR	4	
10	CRANKSHAFT	$7\frac{1}{2}$	
11	WASHER	$2\frac{1}{2}$	
12	M12 NUT	7	
13	CENTRE LINES	$3\frac{1}{2}$	
14	ASSEMBLY	6	
15	LABEL AND SCALE	1	
	TOTAL	**100**	

S

NAME	
NAME	6